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THE DETECTION OF CHICORY IN DECOCTIONS OF CHICORY AND COFFEE.

By Charles H. LaWall and Leroy Forman.

Coffee is subject to a variety of adulterations in whole form, in the ground form and also in the form of the prepared beverage. The detection of adulterants in whole or ground coffee is a comparatively simple matter because of the characteristic appearance of the tissues of both genuine coffee and its adulterants when subjected to microscopic examination. Up to the present time, however, no satisfactory nor conclusive method has been presented in which the adulteration of the coffee could be proved after it was made up into the beverage.

The methods of McGill (*Trans. Royal Soc. Canada,* 1887) and of Tatlock and Thomson (*J. Soc. Chem. Ind.,* 1910), whereby the specific gravity or the refractive index of the decoction is determined, are not only too variable to detect slight admixtures but are valueless in the absence of positive knowledge as to the ratio of ground coffee to decoction. The method of Franz (*Arch. Pharm.,* 1876) in which the color reaction of the suspected decoction with an aqueous solution of cupric acetate is proposed, shows distinct differences between the pure decoctions but fails when applied to mixtures.

The method of Smith (*Pharm. J.,* 1880) depending upon the amount of color left in the decoction after precipitation with basic lead acetate, also fails to detect mixtures of the two.

Tatlock and Thomson (*J. Soc. Chem. Ind.,* 1910), mention the great difference in cupric reducing power of the 10 per cent. decoction but seem to have made no specific application of it as a means of detecting chicory in coffee and their figures are incomplete in this particular respect.

In the light of our present knowledge it is extremely unlikely that any specific tests for the positive identification of chicory in coffee in the prepared decoction can be devised, as no soluble constituents are present in roasted chicory which are not likely to be present in roasted coffee. It is possible, however, to prove adulteration by inferential tests, even when the actual nature of the adulterant is not capable of positive identification, as is seen in numerous cases in which cider vinegar is alleged to be "adulterated by the addition of some unknown substance high in reducing sugars," and in which the cases have been successfully sustained in court and the offenders convicted.

Such an opportunity for inferential proof of adulteration exists as regards coffee and chicory in the prepared decoction.

A number of samples of roasted coffee of authentic origin were obtained, covering all of the important commercial varieties. In these samples were determined, first, the amount of extractive, and second, the percentage of reducing sugars calculated in the extractive previously determined. The amount of extractive matter alone is inconclusive, of course, as no knowledge is usually obtainable concerning the ratio of ground coffee in the decoction. When, however, we come to consider the ratio of the extractive to the reducing sugars, we find that a very sharp line of demarcation exists by which it is possible to conclusively prove the presence of as small an amount as 5 per cent. of chicory in the ground coffee, and experience has shown by the examination of ground samples that smaller amounts than this are not likely to be used.

The results of the examination of the genuine coffees are as follows:

No.			Per cent. of extractive	Per cent. of reducing sugars in extractive
1	Java	(roasted)	1.58	1.92
2	East India	(roasted)	1.64	1.95
3	Mocha	(roasted)	1.98	2.17
4	Bogota	(roasted)	1.70	2.04
5	Mexican	(roasted)	1.72	2.47
6	W. Caracas	(roasted)	2.16	2.64
7	Santos	(roasted)	1.94	2.23
8	Rio	(roasted)	2.02	2.57
9	Peaberry	(roasted)	1.40	2.65
		Maximum	2.16	2.64
		Minimum	1.40	1.92
		Mean	1.79	2.29

Samples of two genuine specimens of roasted and ground chicory showed the following results expressed in the same manner:

No.		Per cent. of extractive	Per cent. of reducing sugars in extractive
1	Chicory	4.70	27.67
2	Chicory	6.10	25.20

It will be seen on comparing the results of coffee and chicory that the extractive matter alone affords no definite information upon which to base a conclusion but that the percentage of reducing sugars in the extractive matter is so widely different as to afford a ready means of detecting chicory in a decoction of coffee.

Sample mixtures of chicory and coffee were made up, using the chicory showing the lowest ratio and the coffee showing the highest ratio. The results were as follows:

Mixture	Per cent. of extractive	Per cent. of reducing sugars in extractive
2 per cent. chicory, 98 per cent. coffee	1.92	2.52
5 per cent. chicory, 95 per cent. coffee	1.96	4.62
10 per cent. chicory, 90 per cent. coffee	2.06	5.26
15 per cent. chicory, 85 per cent. coffee	2.10	7.11
20 per cent. chicory, 80 per cent. coffee	2.52	8.31
25 per cent. chicory, 75 per cent. coffee	2.26	9.25

With the exception of the sample in which 2 per cent. chicory and 98 per cent. coffee were used, which is just within the limits of the highest ratio observed in a pure coffee, the results all decisively and positively point to the adulteration of the coffee with a substance high in reducing sugars. The addition of 5 per cent. of cane sugar to 95 per cent. of coffee did not appreciably alter the results by the reducing sugars method, as shown by the following figures:

	Per cent. of extractive	Per cent. of reducing sugars in extractive
Coffee 95 per cent., cane sugar 5 per cent.	2.40	1.93

While the addition of the cane sugar could very readily be detected by a polarimetric examination, the above mixture showing a reading of several degrees in a 200 mm. tube, the reading of the pure chicory decoction (containing more than ten times the amount of reducing sugars) was negative, owing presumably to an approximate balancing of dextrose and levulose in the mixture.

It was also found that the ozazone produced in the chicory decoc-

tion by the phenylhydrazine method showed the same crystalline form as the ozazone prepared from invert sugar and that a mixture of as small an amount as 10 per cent. of chicory in coffee showed crystals of the ozazone by the phenylhydrazine test, while the pure coffee decoction contains so little reducing sugars as to yield no distinct crystals.

The estimation of reducing sugars in the above work was by the official method in Bulletin 107, U. S. Dept. of Agriculture, Bureau of Chemistry, and the results calculated to dextrose by Allihn's table in the same book.

The foregoing results clearly indicate that a coffee decoction which contains more than 3 per cent. of reducing sugars in its extractive matter may be looked upon as adulterated with chicory or some similar product high in reducing sugars. The method described above may also be used as a confirmatory method where chicory has been detected by microscopic examination.

THE PRESERVATION OF HYDROGEN PEROXIDE BY MEANS OF ACETANILIDE.

By A. M. Clover.

During the past few years, it has become an almost general custom to add a small quantity of acetanilide to solutions of hydrogen peroxide in order to prevent the decomposition ordinarily taking place. This very remarkable property of acetanilide has made it possible for manufacturers to place upon the market a peroxide solution that retains its strength for a long period of time and has eliminated almost entirely the danger arising from decomposition.

There has been some discussion as to the necessity and justification for the use of acetanilide and the claim has been made that the instability of the commercial peroxide solution is brought about by certain impurities, which are introduced during the process of manufacture, and that, were the methods of preparation so controlled as to eliminate these impurities, a stable product would result. In view of the greatly increasing use of hydrogen peroxide this question is one of considerable importance and the following experimental work has been designed to bring out the facts relative thereto. It has been found possible to prepare a chemically pure solution of

hydrogen peroxide in sufficient quantity for experimental work. From a study of the behavior of such a solution we are able to arrive at very definite and indisputable conclusions concerning the effects of various impurities and of acetanilide upon the peroxide.

Preparation of Pure Hydrogen Peroxide.

Commercial hydrogen peroxide, about 3 per cent. in strength, was concentrated by distillation *in vacuo* until a strength of about 20 per cent. was obtained. When a sufficient quantity of this 20 per cent. product had been prepared, it was carefully subjected to further distillation and the distillate reserved; this distillation was continued until the residue showed a strength of from 35 per cent. to 40 per cent. At this point, distilled water was added, sufficient in amount to dilute the residue to 20 per cent. and the distillation continued. This process was repeated until the desired amount of distillate was obtained. In the above distillation the flask was immersed in a bath maintained at 50° and the temperature of the liquid in the flask never exceeded 40°. The vapor was condensed by means of an ordinary Liebig's condenser and the combined distillate contained over 1 per cent. of hydrogen peroxide. When a sufficient quantity of distillate was obtained, it was concentrated by distillation *in vacuo*, the temperature of the bath being maintained at 40° and that of the distilling liquid not exceeding 28°.

Procedure.

For each series of experiments described, a separately prepared lot of peroxide was used, the purity of which had been assured by analysis. In all cases the total residue and the acidity of the preparations were negligible. The strength of the solution in hydrogen peroxide was determined by means of potassium iodide and thiosulphate and as given in the tables is represented by c.c. of N/10 thiosulphate. The strength in which the different substances were added is indicated in the tables by a fraction which is the ratio of the weight of substance to the volume of solution. In series III the acidity is expressed in terms of a normal solution. The solutions were preserved in 4 oz. bottles of amber-colored glass which had been thoroughly cleaned and dried *in vacuo*. Sixty to 75 c.c. of solution were used in each experiment. The bottles were well stoppered and placed in a closet, the corks of the less stable solutions being removed from time to time in order to relieve the pressure.

Series I.—Effect of Several Acids and Salts.

The experiments of series I and II were preliminary and were designed to give a general idea of what behavior might be expected so that the final experiments might be better planned. The substances in series I were added approximately in the proportion of 1.5 gms. to the litre of peroxide solution. One c.c. of the original solution required 14.75 c.c. tenth-normal thiosulphate.

Total time of standing.	4 days.	12 days.	29 days.	53 days.	5 mos.
H_2SO_4	14.65	14.35	13.55	12.45	
H_3PO_4	14.6	14.35	13.80	12.85	
HCl	14.6	14.40	13.90	13.05	
Succinic Acid	14.45	13.95	13.25	12.45	
KCl	14.25	12.75	8.75		
NaCl	14.25	12.40	2.15		
K_2SO_4	13.75	9.10	2.80		
$(NH_4)_2SO_4$	13.15	8.30	2.90		
$MgSO_4$	13.35	8.80	2.50		
$BaCl_2$	14.10	12.25	5.75		
Acetanilide	14. 7	14.65	14.55	14.45	14.30
Original Solution	13.65	11.45	5.65	1.65	

Series II.

One c.c. of the original solution required 13.80 c.c. tenth-normal thiosulphate.

Total time of standing	11 days	23 days	135 days
Original solution	10.75	6.25	
Acetanilide $\frac{1}{2000}$	13.75	13.70	13.45
HCl $\frac{1}{2000}$	13.45	13.00	9.20
HCl $\frac{1}{2000}$ + NaCl $\frac{1}{2000}$	13.30	12.85	0.15
HCl $\frac{1}{2000}$ + Na_2SiO_3 (anhydrous) $\frac{1}{2000}$	13.00	12.15	6.55
H_3PO_4 $\frac{1}{2000}$ + Na_2HPO_4 (anhydrous) $\frac{1}{2000}$	13.30	12.80	8.65
H_3PO_4 $\frac{1}{2000}$	13.30	12.85	8.45
HCl $\frac{1}{2000}$ + NH_4Cl $\frac{1}{2000}$	13.40	12.80	8.45
HCl $\frac{1}{6000}$	12.95	11.90	5.20

SERIES III.—EFFECT OF ACIDS IN DIFFERENT STRENGTHS.

One c.c. of the solutions when prepared, required 16.35 c.c. tenth-normal thiosulphate. In adding the acids the same volume was introduced in each case so that the resulting solutions were all of the same strength.

	Age at time of test	
Strength of acid	6 weeks	7 months
HCl $\frac{n}{25}$	14.80	9.45
HCl $\frac{n}{50}$	14.65	8.30
HCl $\frac{n}{100}$	14.85	8.70
HCl $\frac{n}{200}$	11.80	1.40
H_2SO_4 $\frac{n}{25}$	15.20	9.75
H_2SO_4 $\frac{n}{50}$	14.40	7.75
H_2SO_4 $\frac{n}{100}$	13.75	5.25
H_2SO_4 $\frac{n}{200}$	13.60	4.05
H_3PO_4 $\frac{n}{25}$	15.45	10.65
H_3PO_4 $\frac{n}{50}$	15.40	11.60
H_3PO_4 $\frac{n}{100}$	15.40	11.05
H_3PO_4 $\frac{n}{200}$	15.10	9.55
Boracic acid	8.41	

SERIES IV: SOLUTIONS $\frac{1}{100}$ NORMAL IN HCL. EFFECT OF VARIOUS SALTS ALONE AND WITH ACETANILIDE.

The entire sample of H_2O_2 used in this series was made $\frac{1}{100}$ normal in HCl. The strength of acetanilide was 1 to 2000. The salts were added in strong solution, the same volume being used in each case. Where no salts were added an equal volume of pure water was used, so that all solutions have the same initial strength in H_2O_2. The concentrations of the salts indicated are in terms of the anhydrous compounds. To the solutions containing Na_2SiO_3 there was added enough concentrated HCl to neutralize the former,

the amount required having been previously determined by titration. At the end of six months the solutions to which acetanilide had not been added were found to be so far decomposed that the experiments were not continued. One c.c. of the solutions of Series IV required at the beginning, 21.40 c.c. N/10 thiosulphate.

	Age at time of test.	
	2 months	6 months
Original solution	12.1	3.75
Original solution with acetanilide	21.05	19.85
NaCl $\frac{1}{5000}$	12.5	3.65
NaCl $\frac{1}{5000}$ + acetanilide	21.0	19.95
KCl $\frac{1}{5000}$	12.75	4.20
KCl $\frac{1}{5000}$ + acetanilide	20.95	19.75
$CaCl_2$ $\frac{1}{5000}$	13.05	4.70
$CaCl_2$ $\frac{1}{5000}$ + acetanilide	20.95	19.90
Na_2SiO_3 $\frac{1}{3000}$	10.6	2.65
Na_2SiO_3 $\frac{1}{3000}$ + acetanilide	20.75	19.55
$FeCl_3$ $\frac{1}{500,000}$ + acetanilide	20.40	18.55
$Al_2(SO_4)_3$ $\frac{1}{500,000}$ + acetanilide	21.05	19.90

SERIES V: SOLUTIONS $\frac{1}{100}$ NORMAL IN H_2SO_4. EFFECT OF VARIOUS SALTS ALONE AND WITH ACETANILIDE.

The calcium sulphate was added in pure crystals. In all other cases the same procedure was followed as in making the solutions of Series IV. Just after being prepared, 1 c.c. of the solutions required 22.95 c.c. N/10 thiosulphate.

	Age at time of test	
	2 months	6 months
Original solution	14.35	5.35
Original solution, acetanilide	22.65	22.30
Na_2SO_4 $\frac{1}{5000}$	15.30	6.30
Na_2SO_4 $\frac{1}{5000}$ + acetanilide	22.75	22.35
K_2SO_4 $\frac{1}{5000}$	15.60	6.65

	Age at time of test.	
	2 months	6 months
$K_2SO_4 \frac{1}{5000}$ + acetanilide	22.70	22.25
$MgSO_4 \frac{1}{5000}$	15.80	6.80
$MgSO_4 \frac{1}{5000}$ + acetanilide	22.70	22.35
$CaSO_4 \frac{1}{5000}$	12.80	3.90
$CaSO_4 \frac{1}{5000}$ + acetanilide	22.70	22.40
$ZnSO_4 \frac{1}{5000}$	16.1	7.55
$ZnSO_4 \frac{1}{5000}$ + acetanalide	22.65	22.25
$CuSO_4 \frac{1}{50,000}$	1.00	
$CuSO_4 \frac{1}{50,000}$ + acetanilide	22.60	21.75

Series VI: Solutions $\frac{1}{100}$ Normal in H_3PO_4. Effect of Various Salts alone and with Acetanilide.

The same procedure was followed as with Series IV including the neutralization of Na_2SiO_3 with H_3PO_4. At the beginning 1 c.c. of the solutions required 23.65 c.c. N/10 thiosulphate.

	Age at time of test	
	2 months	6 months
Original solution	17.85	10.60
Original solution + acetanilide	23.35	22.90
$Na_2HPO_4 \frac{1}{5000}$	17.80	10.55
$Na_2HPO_4 \frac{1}{5000}$ + acetanilide	23.40	23.25
$CaCl_2 \frac{1}{5000}$	20.05	15.00
$CaCl_2 \frac{1}{5000}$ + acetanilide	23.20	22.9
$Na_2SiO_3 \frac{1}{3000}$	18.40	11.50
$Na_2SiO_3 \frac{1}{3000}$ + acetanilide	23.40	22.95
$Al_2(SO_4)_3 \frac{1}{50,000}$ + acetanilide	23.40	23.05
$Pb(C_2H_3O_2)_2 \frac{1}{50,000}$	19.75	13.90
$Pb(C_2H_3O_2)_2 \frac{1}{50,000}$ + acetanilide	23.45	23.15

Discussion of Results.

From the results of series I, it is evident that, contrary to the general assumption, pure hydrogen peroxide is a very unstable substance and that its stability is greatly increased by the addition of small amounts of acid. The addition of salts of the alkali and alkaline-earth metals does not appear to have any marked effect. In two or three cases the resulting solutions are more stable and in the other cases they are less stable. By the addition of acetanilide alone to the solution its stability was greatly increased, the decomposition being about 2.7 per cent. in 5 months.

From series II the same conclusion may be reached in regard to the stability of pure hydrogen peroxide, and the effect of acids and of acetanilide upon the solution. The combined effect of acid and its salt and of free silica is here brought out and it is evident that in acidified solutions the salts, at the strength in which they were used, have no influence upon the stability of the solutions, while free silica renders them less stable.

In series III a study was made of the effects, in varying strengths, of the different acids sometimes used in acidifying the commercial solution of hydrogen peroxide. Phosphoric acid gave the best results at all the concentrations used. It will be noted, however, that the best preserved solution had lost in strength nearly 30 per cent. in 7 months and that such a solution, although more stable than the chemically pure peroxide, would not answer at all for commercial purposes.

In series IV, V, and VI there were introduced into the solutions of pure peroxide all of the mineral impurities likely to occur in a commercial preparation, and in the maximum concentrations in which they might be found. In order to cover the ground completely and so that the different series might serve as a check upon each other, three different acids were used with their corresponding salts. Each impurity was used with and without acetanilide so that the effect of this preservative might be seen in all possible cases.

Several different brands of commercial peroxide were examined and the total mineral residue was always found to be less than .05 per cent. This residue was found to consist in all cases, of over 50 per cent. silica, so that the total mineral matter other than silica was less than 1 part in 4000.

The results obtained in the last 3 series of experiments are

invariably the same. The decomposition in those solutions containing acetanilide, is only a small fraction of that in the corresponding solutions which do not contain the preservative.

There can be no question as to the usefulness of this substance for the purpose. As to the mineral impurities, the salts of the alkali and alkaline-earth metals and all other salts used, except those of copper and iron, appear to have no influence whatever upon the stability of the solutions when acetanilide is used. Traces of copper and iron have a very deteriorating effect but this is prevented to a great extent by acetanilide. The concentration of iron used was considerably greater than that which need be present in a commercial solution. Without acetanilide, silica appears to have a deteriorating effect but this result is almost neutralized by the preservative. As previously indicated in the tables, the concentration of acids used in series IV, V and VI was $\frac{1}{100}$ normal, which is the maximum limit allowed by the U.S.P. The decomposition of the preserved solutions of series IV (HCl) was more than twice as great as that in the case of the other two series. An explanation of this may be found in the fact that all the solutions of series IV that contain acetanilide, deposited a yellow sediment of organic matter on standing.

It is of considerable interest to note that the stability of the pure peroxide of series I and II which contains acetanilide alone, is about the same as that of the preserved solutions of series V and VI, which were acidified.

Scientific Laboratory of PARKE, DAVIS & Co.,
Detroit, Mich., Oct. 27, 1913.

SOME OBSERVATIONS ON THE POLLEN OF POISON SUMACH.

BY L. E. WARREN.

From prehistoric times it has been known that contact with certain plants would occasionally produce inflammatory conditions in the skin of human beings. Until within comparatively recent years the belief has been quite general that such plants as the poison ivy and poison sumach, which are more venomous than most others, give off an invisible, mysterious emanation or vapor which, if allowed to touch the skin, produces the complex symptoms so well

known as "ivy poisoning." This vapor was believed to be so insidious and penetrating that sensitive persons could easily be poisoned by passing near the emanating plants without touching them.

That the poisonous principle of this class of plants is a volatile substance appears to have been the belief of all of the writers who have treated the subject previous to 1895. Pfaff and his pupils[1] then demonstrated that the poisonous constituent of poison sumach (*Rhus vernix* L.) and poison ivy (*Rhus toxicodendron* L.) was a non-volatile, resin-like substance. This substance, which Pfaff called toxicodendrol, was found in nearly all parts of these plants. He suggested that toxicodendrol might be a constituent of the pollen of these plants and (since the flowers are dioecious and anemaphilous) it appeared possible that sensitive persons might be poisoned if the pollen were blown upon the face or hands. Pfaff says:[2]

"... The activity of toxicodendrol in minutest traces may make it possible for a few pollen grains of poison ivy to cause skin eruption; and the few cases of action at a distance which are so often quoted, may concievably be thus explained. But, in my own opinion, it is more than doubtful if ever a case of ivy poisoning has occurred without direct contact with the plant or some article which has been in contact with the plant. The long latent period of the eruption in some cases may obviously render mistakes extremely easy as to the occasion when contact with the plant really occurred."

However, Pfaff did not make any examination of the pollen of either poison ivy or poison sumach for toxicodendrol.

Schwalbe[3] has stated the belief that poisoning without direct contact with the plant is easily possible. After a microscopical examination of *Rhus diversiloba* T. & Gr. (the Californian species of poison ivy) he reported as follows:

"... There are in the leaves, in the skin of the stems and stalks of the leaves and flowers, and even in the petals, lactiferous vessels containing the poisonous matter of the plant.

"Upon these vessels grow hairs loaded more or less with poisonous oil. These hairs are prevalent on the stems, on the under surface of the leaves and even on the petals of the plant. The hairs derive the poison by osmosis from the laticiferous vessels and are carried when broken off, easily by the wind or by the help of man or animals to persons liable to the affection. The presence of the hairs on the stem during the winter, when there are no leaves on the shrub explains the fact of the poisonous qualities of the plant

[1] Pfaff and Orr: *Science*, n.s. 1, 110 (1895).
[2] *Jour. Exp. Med.*, **2**, 192 (1897).
[3] *Med. Rec.*, **63**, 855 (1903).

even in winter time. Generally the hairs penetrate into the sudoriferous and sebaceous glands and this observation is corroborated by the fact that those parts of the skin perspiring easily are affected most frequently."

Schwalbe states [4] that the poisonous oil may be detected in and on the pollen grains.

"Der Blüten-staub enhält das giftige Oel in kleinen Mengen; man kann in und an den Pollen Körnnern das Toxicodendrol nachweisen."

Von Adelung,[5] too, inclines to the opinion that the pollen of these plants contains the poisonous oil. He says:

"That persons are poisoned without direct contact with the plant is too common an observation to be denied. The explanation is doubtless the mechanical transportation of the poison, as happens when the pollen, or the plant hairs, or other dust from the plant is carried by air currents. Or, perhaps as commonly, the transporting agents are simply clothes or tools or animals, which, after brushing against the plant, are able to transfer the poison to susceptible persons."

On the other hand Rost and Gilg [6] have studied the toxic effects of *Rhus toxicodendron* from specimens grown in the botanical gardens at Dahlem and have concluded that neither the hairs nor the pollen of that plant contain any of the poison. They obtained the hairs partly by blowing a current of air across the detached branches of the plant while confined in a glass case and collecting the disengaged particles on glass plates moistened with diluted glycerol and partly by placing open dishes containing diluted glycerol under the standing bushes. Their findings for the hairs and pollen of *R. toxicodendron* are exactly the reverse of those reported by Schwalbe for *R. diversiloba.* Since the two plants are so similar botanically and their physiological effects are identical, the differences noted are scarcely to be explained except on the ground of careless observation by one or the other of the experimenters. The studies of Rost and Gilg were so carefully carried out and were, withal, so exhaustive that the preponderance of evidence appears to lie in their favor.

It is known that the poisonous principle of the several species of Rhus is an amber-red, non-volatile, liquid, resinous substance which combines with the alkali hydroxides to form nigrescent compounds

[4] *Muench. med. Woch.*, **49**, 1616 (1902).
[5] *Arch. Int. Med.*, **2**, 148 (1913).
[6] *Ber. Pharm. Gesellschaft*, **22**, 296 (1912).

and otherwise behaves like certain phenolic compounds. The toxic resin exists in the plant in the form of an emulsion which readily blackens with the alkali hydroxides. So delicate is this reaction that minute amounts of the substance may be detected by the microscope if the plant tissues be mounted in an alcoholic solution of potassium hydroxide.

The author has long been skeptical concerning the poisonous properties of the pollen of these plants. Several years since he was informed by Professor A. B. Stevens that he (Stevens) had made some attempts to isolate the poisonous oil from the pollen of *Rhus vernix* but without success. The experiments were few and were not published although attention [7] has already been called to them in print.

During the past summer the author collected some of the pollen from the flowers of *Rhus vernix* L. growing in northern Indiana. Physiological and micro-chemical tests with this demonstrated that it contained no poisonous constituent.

On three occasions [8] during an interval of two weeks during the 1913 flowering season of poison sumach attempts were made by the method given below to procure pollen from numerous male plants:

The apparatus consisted of a two-inch funnel, a four-inch funnel, a 500 c.c. suction flask, a bicycle compression pump and gas tubing. The smaller funnel was attached to the pump by means of the gas tubing while the larger one was fitted into the mouth of the suction flask by means of a perforated cork stopper. The outlet tube of the suction flask acted merely as an escape for air. The inner surface of the larger funnel and the interior of the suction flask were moistened with 75 per cent. alcohol. During the operation the smaller funnel was held near a panicle and by means of the pump a strong current of air was blown for some minutes upon it and into the mouth of the larger funnel which was held upon the opposite side. By this means some pollen was collected but the quantity was much less than desired. Better success was attained by jarring the flowering stems while holding the larger funnel (and flask) directly below.

Some of the pollen which had been disengaged from the anthers of the flowers by shaking the flower stems, was placed on a slide and examined with the microscope. When dry the pollen is in the form of orange-yellow, ellipsoidal grains. If moistened with alcohol or water the grains swell and assume a globular shape. The addition

[7] *Pharm. Jour.*, 83, 562 (1909).

[8] The author is indebted to Prof. A. H. Clark of the University of Illinois School of Pharmacy for aid in collecting the pollen.

of a few drops of an alcoholic solution of potassium hydroxide to the pollen grains on the slide produced no change of color, *i.e.*, by microchemical tests the pollen appeared to contain no poisonous resin. A small quantity of the pollen was then macerated for several hours with 95 per cent. alcohol, the mixture filtered and the solution allowed to evaporate spontaneously to small volume. A portion of the filtrate gave no black color or precipitate when treated with an alcoholic solution of potassium hydroxide. Another portion of the filtrate was allowed to evaporate spontaneously almost to dryness and a drop of the residue tested for poisonous properties, according to the physiological method (slightly modified) of Tschirch and Stevens [9]:

> This consists in thoroughly rubbing a drop of the suspected liquid into the integument of the forearm by means of a glass rod, thus covering a circular area about 1 cm. in diameter. After thirty minutes the part treated is washed with ether, then with alcohol, and lastly with soap and water. If the substance were poisonous the area treated will exhibit a noticeable redness and perhaps slight itching after twenty-four to thirty-six hours. If a negative result be obtained the experiment is repeated with the difference that the test material is allowed to remain upon the arm for from one to two hours. In doubtful cases a third experiment continuing through twenty-four hours should be carried out.

When tested by the above method upon four individuals the alcoholic extract from the pollen of *Rhus vernix* showed absolutely no poisonous properties. Although these tests, perhaps, should not be considered as absolutely proving the innocuousness of the pollen of poison sumach under all conditions they furnish strongly presumptive evidence in that direction. The evidence that rhus poisoning may be wind-borne is materially weakened by the results and the theory that poisoning can take place only by contact with the plant receives additional support.

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[9] Tschirch and Stevens: *Arch. Pharm.*, **243**, 504 (1905); also AM. JOUR. PHARM., **78**, 63 (1906).

FORMATION AND DISTRIBUTION OF ODOROUS PRODUCTS IN PLANTS.[1]

By Eugéne Charabot.

The study of the mechanisms which regulate the formation of the odorous matters and their evolution, the investigation of the relations existing between the chemical phenomena which modify these substances and the immediate manifestations of the life of the plant, the knowledge of the part played by the essential oils in the vital economy, constitute so many enticing problems which, it will be readily conceived, have a capital importance, not only from the point of view of rational cultivation and of judicious harvesting, but also from the point of view of the rational extraction of the perfume of the plant.

To this study I have devoted, either alone or in collaboration, principally with M. Al. Hebert, more than ten years of research work.

The question embraces: the formation and circulation of the odorous compounds; their evolution and the mechanism of this evolution; the genesis of the odorous matters and the physiological rôle of the perfumes.

Formation and Circulation of the Odorous Compounds.—The odoriferous plants form two very distinct groups as regards the distribution of their aromatic principles among the various organs. In some the essential oil makes its appearance in the green organs; in the others it exists exclusively in the flowers. Thus it will be necessary to consider separately the perfume in the entire plant and the perfume in the isolated flower.

The Perfume in the Entire Plant.—We have experimented with various representatives of the vegetable kingdom, belonging to different families and containing the most diversified chemical substances, and we have arrived at the following conclusions:

The odorous kinds of matter make their appearance in the young green organs. They continue to form and accumulate until the flowering period, but with an activity which slackens more or less appreciably. They migrate from the leaf into the stem, and thence

[1] Lecture delivered at the Pharmaceutical meeting of the Philadelphia College of Pharmacy, October 17, 1913.

into the inflorescence, obeying the laws of diffusion: a portion enters into solution and, by osmosis, penetrates into the stem. On arriving in a medium already saturated with similar products, a portion is precipitated, whilst the rest, consisting of a relatively soluble mixture, continues to diffuse through the membranes and reaches the organs of consumption, particularly the inflorescences.

At the time when the work of fertilization is accomplished, a certain quantity of essential oil is consumed in the inflorescence. It is possible and even probable that the green organs produce at the same time further quantities of odorous matters; experiment only permits of the determination of the fact that the difference between the production and consumption is expressed by a loss at the period when the functions of the flower are accomplished.

The practical consequence of this last conclusion is that the harvesting of the perfume-yielding plants should be effected shortly before this consumption takes place, that is, before the act of fertilization.

When this act has been accomplished, the odorous principles appear to descend again into the stem and, generally, into the organs other than the flower, a migration which is probably induced by the dessication of the inflorescences, which involves, other things being equal, an increase in the osmotic pressure and a partial precipitation *in situ* of the least soluble principles.

The Perfume in the Isolated Flower.—There exist, as was supposed by J. Passy and as was proved by A. Hesse and his collaborators, two categories of plants: one class, continuing to produce odorous matters when placed under conditions such that the vital functions may still be exercised; the other class, containing the whole of their odorous principles in the free state and incapable henceforth of producing any further quantity, even though their vitality be not arrested.

Evolution of the Odorous Compounds and Its Mechanism.—These researches, which I have carried out partly in collaboration with M. A. Hebert, have led to the following conclusions: The compound ethers (esters) have their origin, in particularly active fashion, in the green portion of the plants, by the direct action of the acids on the alcohols previously formed. This phenomenon of esterification is assisted by a special agent playing the part of a dehydrating agent, probably an enzyme of reversible activity.

The influences which are capable of modifying the plants so as to

adapt them for a more intense chlorophyllian function are favorable at the same time to esterification, because this function is favorable to the mechanical elimination of water.

Thus the chlorophyllian function tends to acquire a new significance: it not only assures the fixation by the plant tissues of carbonic acid gas, it not only effects, by favoring transpiration, the circulation of the liquids which carry and distribute the principles necessary to the mineral nutrition of the plant, but it also activifies, once the carbon is assimilated, the condensations which enable the passage from a simple chemical structure to one of the innumerable complex structures, the study of which taxes all the ingenuity of the chemists.

When the alcohol is capable of readily parting with the elements of water, it gives rise, together with the compound ethers (esters) to the corresponding hydro-carbon, so that the first transformations which the alcohols undergo are due to phenomena of dehydration.

The phenomena of isomerisation, that is, changes of nature without change of composition, also proceed together with the metamorphosis of the odorous matter. Lastly, the alcohols and their ethers are actively converted into their oxidation derivatives, particularly when the inflorescences appear, in which organs the fixation of oxygen by the tissues is particularly intense.

Genesis of the Odorous Matters.—The sum of my researches, and the interesting observations of M. Hesse lead to a conception of the genesis of the odorous matters in the plant. A large number of the odorous products, very diverse in their functions and chemical structure, are produced in consequence of the splitting up, with fixation of the elements of water, of principles called glucosides. It is sufficient to admit the general nature of such a mechanism to arrive at a satisfactory explanation of the facts observed with regard to the formation of the odorous matters and their appearance at any particular point of the vegetable organism.

It seems to me that there is reason to believe that the glucoside which is capable of yielding the essential oil is formed or tends to be formed in the green portions. Most frequently, this glucoside immediately encounters the conditions of environment which are favorable to its decomposition, and then the essential oil appears in the green portions and begins to circulate, evolve itself and play its part. It may even happen that the medium is so favorable to the splitting up of the glucoside, that the latter can never be formed;

in this case the whole of the essential oil will exist in the free state in the green organs.

In other cases, the glucoside only comes in contact with the ferment which is capable of splitting it, in the flower. It will then only be after it has circulated as far as the flower, undergoing in its course more or less profound modifications, that it will be able to liberate the constituents of the essential oil, and the flower alone will be odorous. It is not impossible that, in certain flowers, the medium may be so favorable to the splitting up of the glucoside, that the latter is completely split up as soon as it arrives there. The formation of further quantities of essential oil in certain flowers in proportion as the essential oil already formed is removed, would be explained by a phenomenon of chemical equilibrium. The following reaction: Glucoside + Water = Glucose + Essential Oil, would be restricted by the reverse reaction, and a state of equilibrium would be reached when the glucose and the essential oil would amount to a certain proportion. Thus the flowers in question, if left to themselves, would retain a quantity of perfume which would not increase. On the other hand, if the essential oil be removed as fast as it is formed, the decomposition of the glucoside would no longer be limited, and it would continue to take place. Consequently, the appearance of a fresh quantity of perfume in the plant whose life is prolonged whilst the odorous matter is continuously removed, follows as the result of a phenomenon of chemical equilibrium in the vegetable cell.

The type reactions will serve as an explanation of the changes:

$R{\cdot}OH \rightarrow R{\cdot}CHO \rightarrow R{\cdot}COOH + (H_2O)n$

$R{\cdot}OH + R{\cdot}COOH \rightarrow R{\cdot}COOR + (H_2O)n$

$R{\cdot}CHOH \rightarrow R{\cdot}CO.R + (H_2O)n$—accounting fo the formation of alcohols and phenols and their aldehyds, acids, esters and ketones, etc.

It will be understood, without it being necessary to insist on it, what advantage we have been able to derive from the practical standpoint as regards the value and the yield of perfume, from all these results obtained by scientific research.

Physiological Rôle of the Odorous Matter.—In collaboration with M. Hebert, I have proved that, contrary to what was previously believed, the odorous kinds of matter are not waste products of which the plant cannot make use. They are capable of being utilized by the plant, particularly when the latter is protected from light and no

longer assimilates the carbonic acid of the air with the same intensity. They participate normally in the work of fertilization and of the formation of the seeds, in the course of which they are partially consumed.

THE ENZYMES AND THEIR IMPORTANCE IN PHARMACOGNOSY.[1]

By A. Tschirch, Berne.

In his opening remarks Professor Tschirch recalled the fact that in an address entitled "The Future of Pharmacognosy," delivered in London on the occasion of the presentation of the Hanbury Medal to him (see *C. & D.*, 1909, II., 548), he had considered it probable that the interest taken in the numerous synthetic remedies would be followed by "a return to drugs." This has taken place sooner than he expected, for quite recently the representatives of two important chemical-pharmaceutical factories informed him that interest in synthetic drugs is declining, and that there is a greater demand for drugs and preparations of them, especially for those which not only represent the active principles, but also the whole of the constituents. This fact draws once more greater attention to that group of remedies which have been employed for thousands of years, and the study of which is the aim of pharmacognosy.

Among the fundamental problems to be solved is the part played by the enzymes, not only in the synthesis of the active principles in the living plant, but also in the transformation of the living plant into a drug. For long it had been a problem for chemists to explain how the plant succeeds in executing at ordinary temperature the same reactions which can be performed in the laboratory only with the aid of energetic agents (strong acids or bases and relatively high temperatures), and how it is able with the utmost facility and in a very short time to perform syntheses requiring a considerable amount of energy, such as the building up of carbohydrates from carbonic acid and water and other photosyntheses. Formerly this ability was ascribed to the "vitality" residing in the living plant alone, and representing its particular source of energy for the accomplishment

[1] Lecture delivered at a general meeting of the Eleventh International Congress of Pharmacy, September 17, 1913. Reprinted from *Chemist and Druggist*, Sept. 20, 1913, pp. 41–43.

of this form of chemical work. To-day, however, the inception and course of numerous reactions in the living substance, which were formerly incomprehensible, can only be grasped by the assumption of enzymatic processes—the enzymes have assumed a part of the functions formerly attributed to "vitality."

We are, however, in the same position with regard to the enzymes as with electricity—we know its action and utilise it, but are ignorant of its real nature. Nobody has as yet held a pure enzyme in his hand, and, as with electricity, there are two points of view: (1) the minority see in enzymatic reactions only an exhibition of a special form of energy, and (2) others maintain that they are of a material nature. From the results of some experiments on the laccase of Kurushi and other materials from the protein reaction of the substance, and the fact that pyrrol is formed when it is heated with alkalies, in addition to the impossibility of separating the enzyme itself from gummy substances, Professor Tschirch assumes as a provisional working hypothesis that the enzymes are glucoproteids of the pyrrol group; but, as he states, this assumption may be right or wrong, and does contribute much towards explaining enzymatic actions. Of greater importance is the recognition of the colloid character of all enzymes; indeed, their action is only comprehensible on this basis in cases where several, often antagonistic, effects are displayed side by side in the same cell. There can be no doubt that not only in the animal, but also in the plant organism, in the same cell several—indeed, many—enzymes are present, of which some—*e.g.*, reductases and oxydases, glucoside-splitting and glucoside-forming—act in direct opposition to each other.

It is now established that the enzymes, like the catalysts, hasten the course of a reaction, that they are destroyed by heating to 70°–100° C., and that they can be "poisoned" by certain substances. On the other hand, the presence of certain substances (some metals, traces of acids and alkalies) enhance their action, but it is still doubtful whether and to what extent the enzymes as such participate in reactions, and whether, as is now generally assumed, the enzyme is not used up in the reaction, but before its effect sets in it enters into an adsorption combination with the substratum.

The fundamental properties of the enzymes were known to Schömein, who discovered the oxidising ferments in the 'sixties of the past century, although in 1809 Göttling, a pharmacist, had observed the peculiar oxydase reactions of gum acacia, without being

able to explain them. Diastase was discovered in 1814, and in 1831 the identity of its action with that of ptyalin in the saliva was established.

Over one hundred and twenty enzymes are at present known, and the action of the majority of these consists in splitting up or transforming, although there is an increasing number of observations dealing with the synthetic *rôle* of enzymes. It has been possible to build up isolactose from *d*-glucose and *d*-lactose, and recently even the glucoside amygdalin has been built up with the aid of yeast maltase. It may be safely assumed that these building-up enzymes play a great part in the synthesis of plant substances. Of great interest is the fact that enzymatic processes may be reversed, as was shown in 1898 by Croft Hill, who proved that a reversible zymohydrolysis was possible.

To understand the processes which take place in the living medicinal plant and in its transformation into a drug and then in the latter itself, it is necessary to pass in review the best-known enzymes. The first and largest group, and the first to be known, is that of the hydrolases or hydratases, among which the carbohydrases are distinguished by their property of splitting up polysaccharides. To this group belong the biases or disaccharases, such as invertase, maltase, trehalase, gentiobiase, and the triases or trisaccharases, such as raffinase, gentianase, rhamninorhamnase and stachyase, as well as the polysaccharases, such as amylase, which splits up starch and is also known under the name of diastase, cellulase (or zytase), inulase, seminase, pectinase, xylenase, and gelase.

The glucosidases, the enzymes capable of splitting up glucosides, are widely distributed, and their principal representative is emulsin, which splits up amygdalin. A large number of these are named with reference to their respective glucosides, and include, *inter alia,* populinase, phloridzinase, salicylase, arbutase, gaultheriase, rhamnase, myrosinase (myrosin), tannase. Another class of the hydratases are the ester-splitting esterases, to which belong the fat-splitting lipase, and chlorophyllase, which is present with chlorophyll.

A particularly important group is that of the proteases and amidases, which includes pepsin and trypsin—pepsin belongs to the proteases. Another group, the coagulases, is mainly represented in animal organisms, and to it belongs chymase, or rennet, which causes the coagulation of milk. Of considerable importance to us are the oxydases, which possess the property of causing oxidation in the

presence of oxygen and peroxides; these are extensively present in medicinal plants, and the guaiacum blue reaction is due to their action. The catalases decompose hydrogen peroxide in oxygen and water, while the reductases are responsible for reductions and also play a part in the living cell.

There is scarcely a living plant-cell free from enzymes; peroxydases and catalases especially appear to be present everywhere, and, as already mentioned, very frequently several enzymes of often antagonistic properties are present in the same cell. Ten enzymes have been isolated from the liver, and five enzymes from the bark of the horse-chestnut—viz., three different oxydases, one catalase and an anaëroxydase. The changes which the plant undergoes *post mortem* in its transformation into a drug are of special interest to pharmacognosy; here we have the phenomenon that, after separation from the plant, many parts undergo considerable changes, particularly of a chemical nature, such as those which occur during the process of drying. In 1888 Professor Tschirch established that within twenty seconds of removing the bark from *Cinchona succirubra* it assumed a reddish color on its inner surface, due to enzymatic action, but if the twig is put in water at 80° C., on removing the bark it does not redden. In the first phase of the process the glucotannide present is split up by a glucosidase, and in the second phase the aglucon thus produced is oxidised to the red coloring-matter by an oxydase. Vanilla affords another example of a different kind of enzymatic action. In 1888 Professor Tsirch found that on destroying the enzymes by alcohol vapor no vanilla odor occurs, and Winckel's experiments in 1909 proved that vanillin is excreted only in non-sterilised fruits.

It may be accepted as proved that in the process of drying glucosides are altered by the action of enzymes, while alkaloids are apparently less affected. The question now arises: What is the effect of drying on the enzymes themselves? Bourquelot found that several plants contain enzymes when fresh only, and that they disappear during drying or on keeping. The most permanent enzymes are found in such drugs as chicory, taraxacum, marshmallow, the gums, and the gum-resins. Gum acacia retains its enzymes for decades, as is also the case with the laccase of Japanese lacquer, which, on oxidation, imparts that special character to Japan-ware.

The question as to whether the enzymes contained in drugs should be destroyed and whether all enzymes possess a medicinal action is

not yet answered. The human organism itself forms so many enzymes that it is extremely probable that those ingested are destroyed or assimilated. Zymase, for instance, is destroyed by the proteolytic ferment of the pancreatic gland. At present there are a number of "sterilised" drugs on the market as well as phamaceutical products made from them—digitalis, for instance; but it must be remembered that the pharmacological action of these "sterilised" drugs must be further studied, as our present knowledge is based chiefly on the use of non-sterilised drugs. A case illustrating the action of enzymes is afforded by gum acacia; mucilage of acacia undergoes considerable changes when mixed with other substances, especially readily oxidised substances, and for this reason the Swiss Pharmacopœia requires it to be heated—*i.e.*, to destroy the enzyme. On the other hand, several enzymes display a useful action. This is apparent in the processes to which such drugs as tea, cocoa, coffee, tobacco, vanilla, and tamarinds are subjected to improve them. With several drugs the perfume is only apparent after enzymatic processes have been at work during drying; thus fresh orris-root is almost odorless.

All these processes have as yet been but little studied, and it is only when we are thoroughly acquainted with the cause, conditions, and course of them that we shall be able to regulate and improve them, and here a wide field of research opens up for pharmacognosy. Our aim is not only to eliminate the deleterious actions of enzymes, but to subject the actions to the service of man and to make them useful for drugs, such as has been done in the preparation of foodstuffs—*e.g.*, in brewing and in making wine, cheese, bread—where the process of "fermentation" is due to enzymatic action. When we have learned to utilise the enzymes formed by higher plants, such as is now the case with myrosin in the preparation of oil of mustard and of emulsin in the splitting up of almond-amygdalin, the number of useful enzymatic actions will be considerably enlarged, and, to quote Goethe, from wonder we shall proceed to consideration, and from consideration to examination. We are led to this thesis by the philosophy of pharmacognosy, and by experiment guided by the process of thought. As Houston Stewart Chamberlain remarks: "La science sans philosophie est un simple bureau d'enregistrement."

PROGRESS IN PHARMACY.

A Quarterly Review of Some of the More Interesting Literature Relating to Pharmacy and Materia Medica.

By M. I. Wilbert, Washington, D. C.

Seldom if ever have interesting happenings along pharmaceutical lines so crowded each other as at the present time, and the end is not yet, for the immediate future promises to yield even more important developments than did the recent past.

The Cocaine Declaration.—Treasury decision No. 33,456 promulgated under date of May 23, 1913, is only just now being brought to the attention of retail druggists through the requirement that all importers making the prescribed declaration must secure similar declarations from all customers to whom cocaine, coca, their derivatives or preparations containing cocaine or its derivatives are sold. The Treasury decision is based on the provisions of the Food and Drugs Law of June 30, 1906, and requires that the importer declare under oath that the goods referred to are imported in good faith and will not be used in any way that may prove to be dangerous to the health of the people of the United States. The text of the declaration also binds the person making it to refrain from disposing of any of the articles involved without securing from the prospective purchaser a similar declaration under oath. The purchaser also agrees to preserve the declarations received by him and to make a report not later than January 15th of each year, of the amount of the materials on hand as well as the amounts bought and sold. The form of the declaration has been published in "Treasury Decisions," 1913, v. 24, No. 22, p. 13; Public Health Reports, v. 28, p. 2122; also in *The Druggists' Circular,* v. 57, p. 698.

Anti-Narcotic Bills.—The several anti-narcotic bills passed by the House some months ago have been reported by the Senate Sub-Committee to the Senate Committee on Finance with several amendments that will not materially affect the purpose or the nature of the bills. The only material change in H. R. 6282 being an amendment to bring that bill in accord with the provision of H. R. 1966, the bill to regulate importation of opium.—*Oil, Paint and Drug Reporter,* 1913, v. 84, November 10, p. 17.

Legislation Relating to Poisons and Habit-forming Drugs.—A

supplement to Public Health Bulletin No. 56: "Digest of Laws and Regulations in force in the United States relating to the possession, use, sale and manufacture of Poisons and Habit-forming Drugs," has recently appeared in Public Health Reports (1913, v. 28, pp. 2111–2147, 2181–2218). This supplement includes 74 pages of closely printed material and contains only references to and abstracts of laws enacted during the year 1913. The number and the nature of these laws appears to evidence a growing discontent with existing conditions and undoubtedly presage a more active enforcement ot laws relating to poisons and Habit-forming Drugs.

Bichloride Legislation.—An article in Public Health Reports for November 14, 1913, (v. 28, p. 2399) comments on the present day agitation for legislation bearing on the sale of corrosive mercuric chloride and points out that the most evident abuse in connection with tablets of corrosive sublimate is the present day practice of marketing them under a misleading title that gives no indication of their toxic character. The article also presents compilations of the number of suicides and of accidental deaths reported to the Registrar-General of England and Wales during the year 1912 which tend to show that the recognition accorded to a poison by its inclusion in the official schedule of poisons has little or no effect on the number of accidental poisonings due to its ingestion while the number of suicides from the use of scheduled poisons is markedly greater than from the use of non-scheduled poisons, or the corresponding deaths from accidental poisoning. This is but a reiteration of the frequently recorded observation that official recognition of a substance as a poison has suggestive influences and that the morbidly inclined are much more likely to use a substance recognized as having toxic properties rather than one regarding the toxicity of which they are in doubt.

Federal Legislation.—Among the recently introduced bills of interest to pharmacists not the least important are several that are designed to restrict interstate traffic in poisonous substances. The first of these, known as S. 3392, was introduced in the Senate by Mr. Ashurst, of Arizona, and is designed to regulate the importation, exportation or carriage in interstate commerce of bichloride of mercury. If enacted into law it would be a misdemeanor to transport in interstate commerce "any substance or poisonous compound known as bichloride of mercury unless said substance or compound be in the form of cubes and colored green so as to be readily distin-

guishable from non-poisonous tablets of similar appearance in common use."

The second bill, known as H. R. 9113, was introduced by Mr. L'Engle, of Florida, and would make it "unlawful for any person to produce, import, manufacture, compound, deal in, dispense, sell, distribute or give away any poisonous tablet, lozenge or troche not cubical in shape" or "any non-poisonous tablet, lozenge or troche not in spherical or disk shape."

A third bill, introduced by Mr. Cary, of Wisconsin, designated H. R. 9237, is designed to amend the District of Columbia pharmacy act and introduces a novel feature in poison legislation in that it requires that all orders, slips or prescriptions for poisons, particularly bichloride of mercury, be in triplicate, in addition to a poison register, and that one of the orders or prescriptions is to be retained as reference and one each is to be filed daily with the police department and the health department of the District.

Poisons.—Xrayser II.—The Poisons Schedule of England shows how difficult it is for legislation to keep pace with chemical research. Drugs having distinctly poisonous action are constantly being put on the market, and it has been pointed out recently that "there are more poisons not on the schedule than there are on it," and all these may be sold or dispensed by anybody, for legally the dispensing of poisons means only those that are scheduled.—*Chem. Circ.*, 1913, v. 57, p. 703.

The A. Ph. A. Election.—The balloting by mail for officers of the American Pharmaceutical Association for the year 1914–15 has resulted in the election of the following: President, Caswell A. Mayo, of New York; Vice-Presidents, L. D. Havenhill, of Lawrence, Kan.; C. H. Packard, of Boston; and Charles Gietner, of St. Louis.—*Drug. Circ.*, 1913, v. 57, p. 703.

Drug Trade Exhibition and Conference.—The exhibition held in the new Grand Central Palace, New York, October 2–9, is not regarded as having been much as a drug show, but was accompanied by a series of good meetings of pharmacists and physicians, and should go far toward awakening an interest in professional pharmacy. The meetings were developed by Mr. Otto Raubenheimer, who deserves credit for the method of conducting them, and for securing the several speakers, who while they confined themselves largely to the discussion of matters of local interest, will nevertheless have considerable influence on the development of pharmacy in other

sections of the country.—*The Druggists' Circular,* 1913, v. 57, pp. 704–705.

Conference of Food and Drug Officials.—The conference of Federal and State officials interested in the enforcement of pure food and drug laws which was held in the City of Washington on November 14 and 15, should have a stimulating influence on the enforcement of pure drug laws as well as being the incentive for more concerted efforts in the enforcement of pure food laws. The conference was called as the result of a resolution adopted by the Association of State and National Food and Dairy Departments for the purpose of providing for active co-operation between State and National officials in the development of methods of analysis, the promulgation of standards and the proper enforcement of existing laws.

International Pharmacy Congresses.—Editorial: "One of the pharmaceutical surprises of the present time is the persistence of the International Congress of Pharmacy. Americans, Britons and Teutons have evidenced a willingness that these Congresses should die, but their pharmaceutical confrères of Gallic or Latin origin have persistently ignored this pessimistic attitude. The principal purpose of the origin of the International Congresses was accomplished by the signature at Brussels on November 29, 1906, of the international agreement respecting the unification of pharmacopœial formulas for potent drugs, which had been arrived at by the International Conference on the subject which had been held there in 1902. Despite the expectation that this international treaty would ring the death-knell of the International Congresses of Pharmacy, it has proved but an incentive in the promulgation of further meetings" of this kind.

The accomplishments of the several Congresses are briefly reviewed, and regarding the Seventh Congress held in Chicago in 1893, during the week commencing August 21, the Editor says, "The meeting was, from the international point of view, a trifle half-hearted, but good as far as it went."—*Chem. & Drug.,* 1913, v. 83, pp. 394–395, 424–426.

The Eleventh International Congress of Pharmacy held at Scheveningen and Leyden, Sept. 17–21, 1913, was well attended and appears to have been successful, though the attendance was largely confined to pharmacists from Holland, Belgium and France. English speaking countries were only sparingly represented; the United States having two delegates, Prof. J. P. Remington, of Philadelphia,

and Prof. J. A. Koch, of Pittsburgh. The chief address, at the general meeting held on September 17th, was by Prof. Alexander Tschirch, who discussed the enzymes and their importance in pharmacognosy.

This Congress was the first to be held after the formation of the International Pharmaceutical Federation, and there is, therefore, no reason to be surprised at the fact that it was from many, if not from all, points of view more successful than any of the ten Congresses which preceded it.

As might have been expected the subject of international standards and the development of uniform methods of assay were discussed at length in several communications, and steps were taken to provide for an international pharmacopœial bureau to compile comments and criticisms along the lines suggested by Prof. Tschirch and to further develop uniformity in the standards and requirements of the several National Pharmacopœias. The trend of the discussion on this and related subjects is well reflected in the papers and abstracts published in British pharmaceutical journals and the following will serve to illustrate the interest shown by the delegates present. (See also this JOURNAL, pp. 496, 534).

Compiling a Pharmacopœia.—Boldingh and Schoorl: The monographs of a pharmacopœia should be succinct and clearly subdivided, the tests for identity, impurity, and adulteration to be specially mentioned and printed in distinctive type; the order in which groups of reactions are given should be the same in all monographs; the number of reagents should be limited, replacing by others where possible inconvenient reagents (as H_2S and CS_2 by Na_2S and chloroform); they should also place in the first rank the observation of physical characters, the determination of physical constants, such as melting and boiling points, rotation power, and refractive index, and the microscopical examination of crystals.—*Chem. & Drug.*, 1913, v. 83, p. 488.

Alcoholic Strength.—van der Wal, G. H.: Discussed the desirability of adopting a uniform degree of alcoholic liquids for the preparation of medicinal substances expressed in percentage by weight. The author recommended the appointment of a committee to decide on an international table of mixtures of alcohol and water, percentages to be stated in weight, this table to be published by the International Pharmaceutical Federation.—*Chem. & Drug.*, 1913, v. 83, p. 490.

Galenical Preparations.—Dulière, W.: The value of a galenical medicament depends on the quality of its constituents and on the care with which it is made, and on neither of these points is it possible to have any certainty where the galenical is purchased ready made. The practical pharmacist knows by comparison that a product is abnormal, though he may not always be able to submit his proofs, but the inexperienced pharmacist does not know, and he is the one who procures these ready-made preparations.—*Chem. & Drug.*, 1913, v. 83, p. 484.

Minimum and Maximum Standards for Drugs.—Peck, E. Saville: The establishment of a minimum standard for the active parts of medicines without establishing a maximum is wrong. Although in a large number of cases the establishment of a maximum standard is unnecessary; it is in many others essential for the attainment of accurate and constant therapeutic effect.—*Pharm. J.*, 1913, v. 91, pp. 433–434.

Unification of Assay.—Hérissey, H.: Thinks it advisable to impose international methods of assaying medicines at the same time that the content in active principles is laid down. The assay process should be minutely described, and in cases where the strength of the galenical is to be adjusted from an assay, the method of preparation should be described.—*Chem. & Drug.*, 1913, v. 83, p. 485.

Purity Tests for Chemicals.—Bührer, C.: Favors a periodical revision of the pharmacopœias, every ten years where possible; a permanent commission in each country to which would fall the work of keeping in touch with scientific progress; and the creation of an International Pharmacopœial Bureau for the carrying out of the ideas put forward by Professor Tschirch.—*Chem. & Drug.*, 1913, v. 83, p. 485.

International Pharmacopœial Bureau.—Remington, Joseph P,: An International Pharmacopœial Bureau should be established in Europe. Success will depend upon the ability of the director. The detection of adulteration and the collection of information about fraud would be an important part of the work. Abstractors should aim at obtaining facts and should not be critical. The unification of standards and tests for chemical substances should be taken in hand, and the formation of a purity rubric for each chemical medicament.—*Chem. & Drug.*, 1913, v. 83, p. 487.

Regarding the organization of this Bureau, the following resolution was adopted: The Eleventh International Congress of Pharmacy

desires to see continued the work toward the unification of Pharmacopœias so happily inaugurated by the Brussels Conference for the unification of heroic medicines. Considering that an International Congress is not qualified to give a pronounced opinion as to the work to be done by a similar institution, the second section asks the general meeting to appoint a commission, to submit within two months an organization scheme for an International Pharmacopœial Bureau. The scheme elaborated by this commission will be transmitted to the office of the International Pharmaceutical Federation, which within a month will communicate it for examinations to the official Commissions of the Pharmacopœias of the different countries.—*Chem. & Drug.*, 1913, v. 83, p. 490.

The invitation presented by Prof. A. Tschirch to hold the Twelfth International Pharmaceutical Congress in the city of Berne, Switzerland, was adopted at the concluding session of the Congress and the question of date was referred to the International Federation of Pharmaceutical Societies.

Narcotic Drugs.—C. E. Terry, Health Officer for Jacksonville, Fla., in a paper on "drug habitués and their bearing on the public health and welfare," read before the American Health Association at Colorado Springs, laid the blame for drug victims upon physicians. He stated that 50 per cent. of drug-users become so through taking drugs prescribed during illness, and declared that physicians are more dangerous than druggists in this respect. He favored State legislation to further physicians and druggists minimizing the practice of prescribing strong drugs to those addicted to their use.—*Pharm. Era*, 1913, v. 46, p. 508.

Mixtures of the United States Pharmacopœia.—Osborne, Oliver T.: Seriously questions the advisability of including in the Pharmacopœia of the United States a number of the now official complex mixtures because many of the ingredients are needless and useless. In fact it is generally recognized that these complex mixtures themselves are unscientific.—*J. Am. M. Assoc.*, 1913, v. 61, pp. 1289–1293.

Norwegian Pharmacopœia.—Den Norske Farmakope, 1913: The fourth edition of this Pharmacopœia has been finally issued and will be official from January 1, 1914. It will replace the work published in 1895, so that with the exception of Portugal, Great Britain now possesses the oldest Pharmacopœia now in force. In accordance with an existing agreement, the Latin nomenclature is in accord with that of the other Scandinavian countries, Sweden and Denmark,

and is quite distinct from that of other European countries. The requirements of the Brussels Conference are reproduced in tabular form, and the articles corresponding to these that have been included in the Pharmacopœia are designated by the addition of the letters "P. I." to the sub-title. Somewhat striking is the relatively small number of galenical preparations included, 196 in all; thus there are only 29 tinctures in the Norwegian Pharmacopœia as compared with 67 in the British Pharmacopœia and 41 in the German Pharmacopœia.—*Chem. & Drug.*, 1913, v. 83, pp. 586–587.

British Imperial Pharmacopœia.—The proposals put forward by Mr. John C. Umney in his presidential address to the jubilee meeting of the British Pharmaceutical Conference have been received with much favor by pharmacists in Australia, and although the several propositions have not been discussed or even formally considered in England itself, it is believed that the propositions are favorably viewed so that the opinions of all pharmaceutical bodies beyond the seas should be ascertained for consideration when the time comes.—*Chem. & Drug.*, 1913, v. 83, pp. 669–670.

Hanbury Medal.—American pharmacists generally and graduates of the Philadelphia College of Pharmacy particularly were pleased to learn that the Hanbury medal was this year awarded to Dr. Frederick Belding Power, now the Director of the Wellcome Research Laboratories, London, England. Dr. Power was also accorded the unusual honor of being asked to deliver the address at the opening of the School of Pharmacy of the Pharmaceutical Society. The subject of this address which is reported in full in recent numbers of English drug journals was: "The influence and development of some of the researches of Daniel Hanbury."—*Chem. & Drug.*, 1913, v. 83, pp. 36, 61.

Drugs Sold to Dispensing Physicians.—Puckner, W. A.: Reports a comprehensive investigation on the quality of drugs sold to dispensing physicians and concludes that the examinations reported show that the random charge of sophistication and adulteration which has been repeatedly made against "physicians' supply houses" is unjustified. The examination does show as has been argued before, that standard drugs are likely to be of fair quality irrespective of the source from which they are obtained.—*J. Am. M. Assoc.*, 1913, v. 61, pp. 855–859.

How to Secure Reliable Drugs.—Howe, Oliver H.: While the modern drug store may be a social necessity as a general emporium

of all sorts of small wares and ready-made medicines, for confectionery, cigars and fancy articles, it cannot and should not be relied upon as a source of reliable medicines. The well-equipped and conscientious druggist who has a high standard of work and lives up to it should be encouraged. No physician should jeopardize his patients or his own reputation by relying on a prescription service which he knows to be poor. If necessary, he should provide and dispense his own medicines.—*J. Am. M. Assoc.*, 1913, v. 61, pp. 1392–1393.

Alcohol as a Food.—Editorial: To say that alcohol may be a food is not to deny that it is a dangerous one. If it is given too freely its oxidation is incomplete and, what is more important, the untoward nervous effects become prominent. In ordinary conditions of health there is no occasion for the use of alcohol, and its introduction into the regimen of daily life can scarcely be defended on the grounds of nutritive needs.—*J. Am. M. Assoc.*, 1913, v. 61, pp. 966–967.

Alypin.—Schroeder: Does not agree with the statement of Impens that the toxicity of alypin is much lower than that of cocaine and that the maximum dose for the human subject is 0.2 gm. of alypin and 0.05 gm. of cocaine. He maintains that alypin is at least as toxic as cocaine, and supports the maximum dose given for it by L. Lewin, 0.05 gm., which has been adopted in the supplement to the Pharmacopœia published by the German Apotheker Verein. (*Deut. Med. Woch.*, 1913, 1, 459; *Apoth. Zeit.*, 1913, 28, 590).—*Pharm. J.*, 1913, v. 91, p. 504.

Balsam of Peru and Perugens.—Enz, Karl: All of the samples of genuine balsam of Peru examined complied with the requirements of the Pharmacopœia. The specific gravity occasionally shows a tendency to exceed the permissible limit. The tests given by the German Pharmacopœia will not eliminate perugens or other factitious balsams of Peru; some indication is, however, given by a comparison of the acid number, the iodine number of the isolated cinnamine, the nitric acid reaction and the behavior of the product with petroleum ether.—*Südd. Apoth. Zeit.*, 1913, v. 53, pp. 600, 608–609.

Brophenine, is a complicated phenetidine derivative, bromoisovalerylamino-acetphenetidine, of the formula $C_2H_5.O.C_6H_4NH.CO.CH_2.CO.CHBr.CH(CH_3)_2$. It is a white amorphous powder, slightly soluble in water, odorless, and tasteless, melting at 150°. Dose: Five to 20 grains three times a day.—*Chem. & Drug.*, 1913, v. 83, p. 526.

Capsules.—Editorial: The gelatin capsule was invented by Mothes in 1833, and the French Academy of Medicine declared his invention to be an immense service to science and humanity. On March 25, 1834, Mothes and Dublanc applied for a French patent for gelatin capsules, and they obtained an additional patent on December 4th of the same year.—*Chem. & Drug.*, 1913, v. 83, p. 458.

Despyrin.—A remedy stated to be tartryl-salicylic acid has been put upon the market as the latest headache and neuralgic remedy. It has been examined by German analysts, who state that it is a mixture of acetyl-salicylic acid with potassium bitartrate.—*Chem. & Drug.*, 1913, v. 83, p. 358.

Digitalis.—Eggleston, Cary: Reports some clinical observations on the emetic action of digitalis and concludes that there is neither valid experimental nor clinical evidence that therapeutic doses of the digitalis bodies cause nausea or vomiting through local irritant action on the alimentary tract. All true digitalis bodies produce nausea and vomiting by direct central action, so that it is fallacious and wholly irrational to seek to avoid these symptoms resulting from the oral administration of any given preparation by resort to another preparation or to another channel of administration.—*J. Am. M. Assoc.*, 1913, v. 61, pp. 757–761.

Electr-HG.—Electromercurol is a colloidal suspension of mercury equivalent to 0.1 per cent. metallic mercury (Hg) and containing a small percentage of sodium arabate. Electr-Hg is an odorless, tasteless liquid appearing transparent and brown in color by transmitted light and opaque and gray by reflected light. The addition of potassium cyanide solution or of strong nitric acid yields clear, colorless solutions. The nitric acid solution responds to tests for mercury.—*J. Am. M. Assoc.*, 1913, v. 61, p. 868.

Hexamethylenamine.—Cuntz, W.: States that this drug (urotropin) cannot be regarded as absolutely harmless. With the usual dosage he has witnessed hematuria and albuminuria develop in two cases. (*Münch. med. Wchnschr.*, 1913, 40, No. 30).—*J. Am. M. Assoc.*, 1913, v. 61, p 815

Kresophine consists of coal tar deprived of all constituents other than phenols and derivatives of pyrocatechin. It forms a reddish-brown liquid, which is free from any burning taste, and is easily miscible with all organic solvents. Its use is identical with that of other coal tar products.—*Chem. & Drug.*, 1913, v. 83, p. 526.

Melubrin is described as sodium 1-phenyl-2,3-dimethyl-5-pyrazo-

lon-4-amido-methan-sulphonate, the sodium salt of 1-phenyl-2,3,-dimethyl-5-pyrazolon-4-amidomethan-sulphonic acid, differing from antipyrine, $C_{11}H_{12}N_2O$, in that a sodium-amido-methan-sulphonate group, $NH.CH_2.SO_3Na$, has replaced a hydrogen atom of the pyrazolon group. It is a white, odorless, almost tasteless crystalline powder, readily soluble in water, but slightly soluble in alcohol. The aqueous solution is neutral in reaction but unstable.—*J. Am. M. Assoc.*, 1913, v. 61, p. 869.

Mesothorium.—Berlin Correspondent: All Germany is obsessed with the idea of procuring mesothorium to be used as a panacea for cancer. It is said to have the power of emanating rays similar to, but much more effective than radium, and the cost seems to be about as great. The substance is derived from the thorium waste in the manufacture of gas mantles, but proof is still wanting of the efficacy of the remedy.—*Chem. & Drug.*, 1913, v. 83, p. 447.

Methyl Alcohol.—Kroeber, Ludwig: Reviews the different theories in the famous Berlin poisoning case, and concludes that pure methyl alcohol has not the great toxicity attributed to it by certain authors. He finds that traces of dimethylic sulphate formed in the course of purification of the product are capable of poisonous action. —*Chem. & Drug.*, 1913, v. 83, p. 488.

Ninhydrin occurs in the form of colorless crystals readily soluble in water. When heated it becomes red at 125° C., swells at 139° and melts at 239–240° C. The aqueous solution colors the skin violet and reduces Fehling's solution. When heated to the boiling point in aqueous solution it gives a blue color in the presence of protein bodies or amino acids derived from them which have the amino group in the alpha position in relation to the carboxyl. It gives this reaction with compounds that no longer respond to the biuret reaction. Ninhydrin is not employed therapeutically, but is used as a reagent to determine the presence of albumin, peptone, polypeptids, and amino acids. This test is especially applied to demonstrate the presence in blood serum of specific proteolytic ferments, especially in the diagnosis of pregnancy, according to the method of Abderhalden.—*J. Am. M. Assoc.*, 1912, v. 61, p. 1377.

Ninhydrin Reaction.—Pearce, Richard M.: Reports negative results with the ninhydrin reaction as a test for amino acids in the serum of nephritics and others. A few tests were made also with ascitic fluid, but with like negative results.—*J. Am. M. Assoc.*, 1913, v. 61, pp. 1456–1457.

Novocol is sodium guaiacol phosphate. It forms a white crystalline powder, easily soluble in water and containing 45 to 50 per cent. of guaiacol. It is recommended in cases where guaiacol is indicated, in doses of 0.5 gramme three times a day.—*Chem. & Drug.*, 1913, v. 83, p. 526.

Paracodine is dihydrocodeine, prepared by reducing the alkaloid by nascent hydrogen. It is a strong base, forming needles melting at 65°, and is soluble in water. It is prepared in the form of the tartrate and the hydrochloride, both of which salts are easily soluble in water. It is recommended as a cough remedy in very small doses. —*Chem. & Drug.*, 1913, v. 83, p. 526.

Placentapepton is a preparation of peptone derived from the placenta and employed for the purpose of the optical tests for pregnancy according to Abderhalden. Placentapepton is a yellowish powder, soluble in water, and having the properties of peptone.—*J. Am. M. Assoc.*, 1912, v. 61, p. 1377.

Phenolsulphonephthalein.—Fishbein, M.: A report of a number of observations on the use of phenolsulphonephthalein as a functional test of the kidneys in scarlet fever. In the cases reported the dye was injected intramuscularly and elimination determined by the use of the colorimeter described by Cabot and Young (*Boston Med. and Surg. Jour.*, 1911, clxv, 549).—*J. Am. M. Assoc.*, 1913, v. 61, pp. 1368–1370.

Salvarsan.—Robertson, H. E.: Intramuscular injections of salvarsan and neosalvarsan produce severe destructive lesions which always heal slowly and often are complicated with hæmorrhages and sloughing abscesses. The severity of the reaction from the use of either drug is essentially the same, and the lesions produced by experiments on animals and in human beings are similar in every respect. Mercurial preparations when injected into muscles produce similar lesions, and the use of such preparations in this manner, in the majority of cases, is an unjustifiable procedure.—*J. Am. M. Assoc.*, 1913, v. 61, pp. 1698–1702.

Tannaphtol is a condensation product of tannic acid, albumen, and benzonaphthol. It is an amorphous powder, used as an internal antiseptic, or externally as a dusting powder.—*Chem. & Drug.*, 1913, v. 83, p. 526.

Tuberculin.—Editorial: The position of the pharmacist in relation to the supply of tuberculin is not so simple as it would appear. According to White, there is no such thing as standard tuberculin and

no tuberculin manufacturer can guarantee that his product is of the same strength twice. There is no means of testing the strength of any given tuberculin save by experiments on the body of the patient whom it is proposed to treat. Considering the dangerous nature of this remedy it is a very serious matter. The situation is rendered still more difficult by the bewildering series of tuberculins issued by the various makers. The following list of initials are only a few that might be quoted: T. O., T. R., T. B. E., V. T., P. T. O., P. T. R., P. B. E., P. V. T., B. F., P. B. F., I. K., besides fat-free, water-extract, suspensions of various kinds, and modifications advocated with a wealth of literary embroidery by Dr. A., Dr. B., and so on *ad infinitum.—Chem. & Drug.*, 1913, v. 83, pp. 362–363.

Vaccine Therapy.—Richards, John H.: Reviews the recent literature relating to vaccine therapy and concludes that vaccines are for one purpose only, that is, to produce prophylactic immunity and to increase the resistance of an individual by active immunization, and they should never be used to the exclusion of other methods of treatment that tend to limit the extent of an infection.—*J. Am. M. Assoc.*, 1913, v. 61, pp. 845–847.

Volatile Oils.—Book Review: Calls attention to the second volume of "Die Ætherische Œle," by Gildemeister and Hoffmann. The matter which occupies this second section of the work is the detailed description of the known oils, arranged systematically according to the natural orders of the plants from which they are derived: the present volume includes cryptogams, gymnosperms, monocotyledons, and a considerable number of dicotyledons. The work of Gildemeister and Hoffmann is certainly the most up-to-date, as it is also the most comprehensive on the subject, and it is safe to say that no chemist who is concerned with volatile oils can afford to be without it.—*Pharm. J.*, 1913, v. 91, p. 438.

The Bad Taste in Hypochlorite-treated Water-supplies.—Editorial: There has been frequent and often bitter complaint about the taste of water treated with hypochlorite solution, and while it is recognized that the danger from water-borne diseases is greatly reduced by the hypochlorite treatment, the necessity of having to bear the burden of daily complaint and to meet the indignant protests of thousands of aggrieved water-drinkers, has no doubt been a factor in preventing the efficient use of hypochlorite. Lederer (Proc. Ill. Water Supply Assn., 1913, p. 235) has confirmed the advantage of

sodium thiosulphate for neutralizing the residual chlorine.—*J. Am. M. Assoc.*, 1913, v. 61, p. 1461.

Venereal Diseases.—An important discussion in the Sections of Dermatology and Syphilography of the International Medical Congress centred about the control of venereal diseases. These sections passed resolutions urging the government to institute a system of confidential notification of syphilis to a sanitary authority and to make systematic provision for the diagnosis and treatment of all cases of syphilis not otherwise provided for. Sir Malcolm Morris said the state enforces the notification of many infectious diseases, takes charge of the insane, encourages the authorities to build fever hospitals, carries out a rigid inspection of factories and work-shops, and in a thousand ways stretches out its long arm to safeguard the community, yet it does not lift a little finger to protect the nation from a devastating disease which, more ruthless than the destroying angel who slew the first-born, smites the unborn babe.—*Chem. & Drug.*, 1913, v. 83, pp. 331–356.

PHARMACEUTICAL MEETING.

The first Pharmaceutical Meeting this fall was held in the Museum of the College on October 17, with Eugéne Charabot of the Sorbonne, Paris, the guest of honor. The major part of his address on the " Formation and Distribution of Odorous Products in Plants " is found in another part of this issue. Professor Samuel P. Sadtler presided and introduced Dr. Charabot as one of the world's recognized authorities on Volatile Oils.

The carbohydrates, albuminoids, and the fatty substances, which comprise the important products of plant metabolism have been thoroughly studied. But there is a multitude of more ephemeral products, often unsuspected in their normal presence, among which are the odorous compounds. The subject of perfumery, therefore, Dr. Charabot suggested, while having great practical aspects, deserves well a place in our knowledge of a purely philosophical order and is closely allied with and depends upon the subject of physiological botany. With this introduction the speaker endeavored to give the proper perspective to his subject. While the address was given in French, it was thoroughly enjoyed by those who attended, even though not very familiar with the language, due to the very engaging style of Dr. Charabot.

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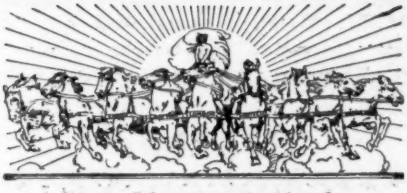

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